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Short Paper
Corresponding Author:
johanna.schmitt@researchstudio.at
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Assessment of Recreational Green Space Quality and Supply

Johanna Schmitt and Günter Gruber
RSA iSPACE Salzburg, Austria

Abstract

This paper evaluates the experience quality of recreational green spaces in the functional urban area (FUA) of Salzburg. The assessment is based on the calculation of spatial indicators assigned to the three indices ‘nature and scenery’, ‘properties and infrastructure’ and ‘accessibility’. These are combined to give an integrated recreational value, which serves as an input to determine the reachability of green spaces with different quality levels in terms of walking and biking distances. The analysis covers all populated grid cells as the initial part of a supply and demand study. The results show a good supply in the city centre, although often not equally distributed over all indices, but a noticeable lack of reachable recreational areas along with an almost complete deficit of high-quality spots in more highly populated peri-urban areas. This study is a preliminary approach for an integrated green-space assessment at FUA level, addressing the lack of research on the recreational potential of the rural–urban hinterland. The findings will be used as a starting point for a more profound evaluation of supply and demand of green qualities, including other types of green land and further ecosystem services.

Keywords:

green infrastructure, recreational value, spatial indicators, functional urban area

1 Introduction

Green infrastructure (GI) plays an essential role in the sustainable development of cities and their environments, providing the main ecosystem services and a variety of economic, social and psychological benefits (Breuste et al., 2015). Preserving these functions is essential for pursuing sustainable development goals in terms of wellbeing and prosperity. The investigation of green qualities in urban agglomerations is particularly important, since the share of the population living within such environments is constantly growing. High pressure on (peri-)urban green spaces gives rise to increasing land-use conflicts, which require urgent and innovative solutions for spatial planning and development. GI planning is closely related to political decision-making, addressing social demands, implementing corresponding policies, and adapting to changing conditions (Gälzer, 2001). Spatial indicators are widely used for multi-level GI assessment (e.g. Van Herzele & Wiedemann, 2003) as they synthesize information for the analysis of complex phenomena. GIS methods and tools enable mapping, modelling and monitoring of GI and, together with appropriate indicators and participatory approaches, give insight into individual perceptions and contribute to quality-of-life studies (Keul & Prinz, 2011; Kothencz & Blaschke, 2017). Fan et al. (2017) present an accessibility index of public green spaces, though with few quality criteria to identify hot and cold spots of supply. The Urban Development Strategy of the Magistrat Salzburg (2009) describes the city's green share and the quality of its supply with regard to recreational facilities. However, little research has been carried out on the experiential value of suburban GI, since it has often been regarded as ubiquitous and a terrain for the analysis of (rural) ecosystem services (Kroll et al., 2012). Whereas Derkzen et al. (2015) bridge this gap by quantifying urban ecosystem services, this paper elaborates on indicators to evaluate recreational quality at the level of functional urban areas (FUA) and so transfers established approaches from urban to peri-urban environments. On this foundation, it presents a preliminary study on demand and fair supply for residents.

2 Methods

This paper presents a transferable approach for GI quality assessment in FUAs (an FUA is defined in general as a city and its commuting zone), using part of the Salzburg FUA as an example. The study area comprises the city of Salzburg and ten smaller municipalities located to the south. While the city consists of an urban core and rural fringes, most of the other municipalities can be characterized as provincial. The approach used for this study is based on a transnationally elaborated framework that collects spatial indicators and GIS methods for assessing and monitoring different types of green spaces based on the analytical pillars 'maintenance', 'sustainability', 'attractiveness' and 'profitability'. The framework serves as a model kit because the pillars and indicators can be combined in different ways, depending on the analytical goals (e.g. touristic potential, agricultural value, or ecological importance of green spaces). For the pilot site of Salzburg, indicators assigned to the attractiveness pillar in particular were elaborated to analyse the recreational value of green spaces for residents, without using qualitative data. In this paper, we focus on the quality and accessibility of zoned recreational areas.

Since independently of each other single indicators do not provide enough meaningful information, they were assigned to one of three indices considered most important for the evaluation of recreational GI assets in terms of attractiveness for visitors: nature and scenery, properties and infrastructure, and network-based accessibility. Indices are meta-indicators that provide added value to single-indicator calculations and thus allow a multi-level assessment of complex real-world phenomena. Each index consists of a set of indicators that were developed based on the scientific literature. These indicators were supplemented with our own inputs in order to classify the quality of elements (see Figure 1). The indices were analysed separately and then combined to give an overall recreational value.

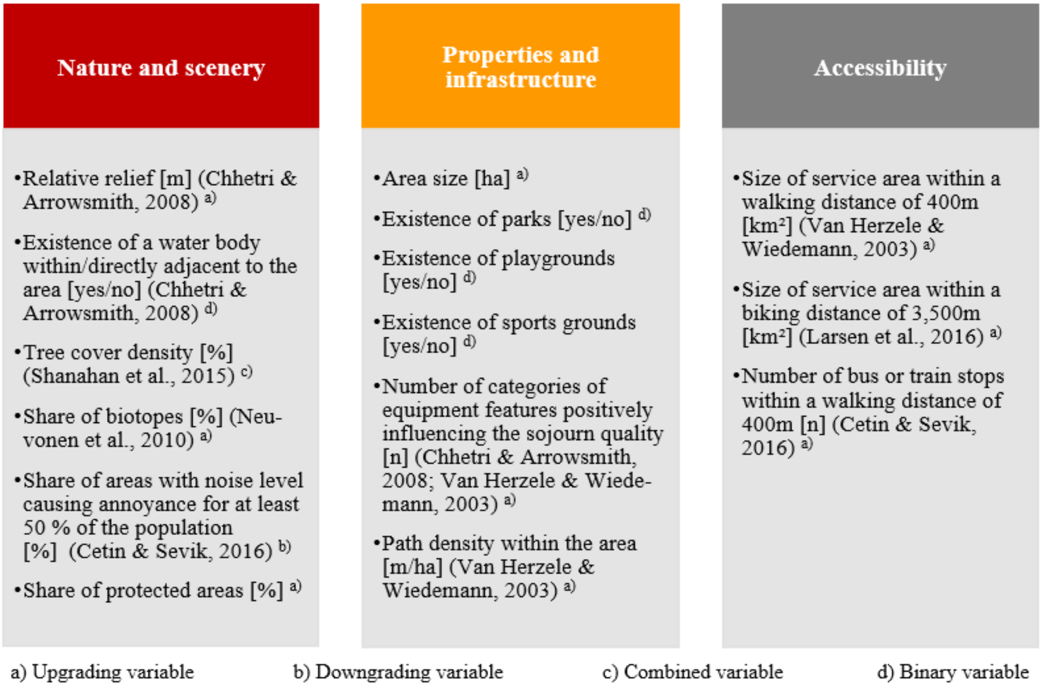

Figure 1: Indices and indicators used for the derivation of the recreational value

Each indicator was calculated individually by using 289 zoned public recreational areas as inputs. These areas include parks and playgrounds, but also riverbanks and other similar areas. This part of the analysis was conducted at object level using open data from OpenSteetMap (OSM) and SAGIS (GI system of the Federal State of Salzburg) as the main data sources. The three indices were derived by calculating the weighted average of the appropriate indicators. For the indices 'nature and scenery' and 'properties and infrastructure', in each case two indicators received a higher weight. With respect to the lower number of indicators in the 'accessibility' index, only one input indicator was considered to be of higher significance. In each of the three cases, the remaining percentages were distributed equally among the other indicators. The following list shows the indicators with the highest weights, as used for the next steps of the study:

- Nature and scenery: tree cover density (35%), existence of water bodies (35%)
- Properties and infrastructure: number of categories of equipment (25%), path density (25%)
- Accessibility: size of service area within a walking distance of 400m (50%)

The focus of the 'nature and scenery' index is on indicators referring to characteristics that are directly visible for visitors to recreational areas and that can be considered as more significant. For 'properties and infrastructure', the diversity of equipment features (e.g. benches, toilets, information panels) and the walkability of the area itself were considered highly valuable, as they contribute strongly to the experience value of a green space. In determining realistic weights, analyses were performed that showed that area size and path density are highly sensitive for the assessment results. These two features were thus weighted more moderately than first planned. Finally, the accessibility on foot received a high weight because it is the form of travel considered most often in the scientific literature (e.g. Gälzer, 2001; Van Herzele & Wiedemann, 2003). The results of the three indices were used to define the integrated recreational value of each area by determining their arithmetic mean. This approach would also allow the calculation of a weighted average, depending on the goals aspired to. In our case, however, every index was deemed equally important.

To identify the supply of recreational areas, their reachability on a network basis was calculated by overlaying a 250x250m population grid with service areas of all recreational areas, including the distance classes 400m (walking distance for all age groups), 1,000m (walking distance for mobile persons), and 3,500m (biking distance). The results comprise the highest quality-level that can be accessed from each populated grid cell, since it is assumed that residents will prefer the most attractive areas for their recreational activities. Potential individual preferences have not been considered yet.

3 Results

Table 1 provides an overview of the share of recreational areas per quality level for all indices, and the integrated recreational value. It shows significantly high shares of recreational areas that are of low quality in terms of infrastructural equipment features, but large shares of areas that are medium- or high-quality with regard to accessibility.

Table 1: Share [%] of recreational areas per quality level for every index

	Nature and scenery	Properties and infrastructure	Accessibility (on network basis)	Integrated recreational value
Levels 1+2 (low quality)	45.3	72.3	20.4	52.6
Level 3 (medium quality)	37.7	19.4	42.9	36.3
Levels 4+5 (high quality)	17.0	8.3	36.7	11.1

Figure 2 presents a series of maps showing the results for each index and the integrated recreational value for a part of the study area. Most of the green areas obtain good values for at least one index. But as expected, there are local disparities between urban and suburban zones: the assessment shows that the quality of recreational areas is in general considerably higher in the urbanized area, although note-worthy differences between the single indices could be detected (see Table 1). However, in most cases at least one assessment pillar obtains high values, which results in a notably high number of recreational areas achieving an integrated value of 2 or 3. A correlation between area size and recreational quality can be assumed because the ten largest areas (>20ha) have a quality level of 4 or 5. Areas in the city of Salzburg itself especially achieve high quality values for every index, while most of the values for the other municipalities are low or medium.

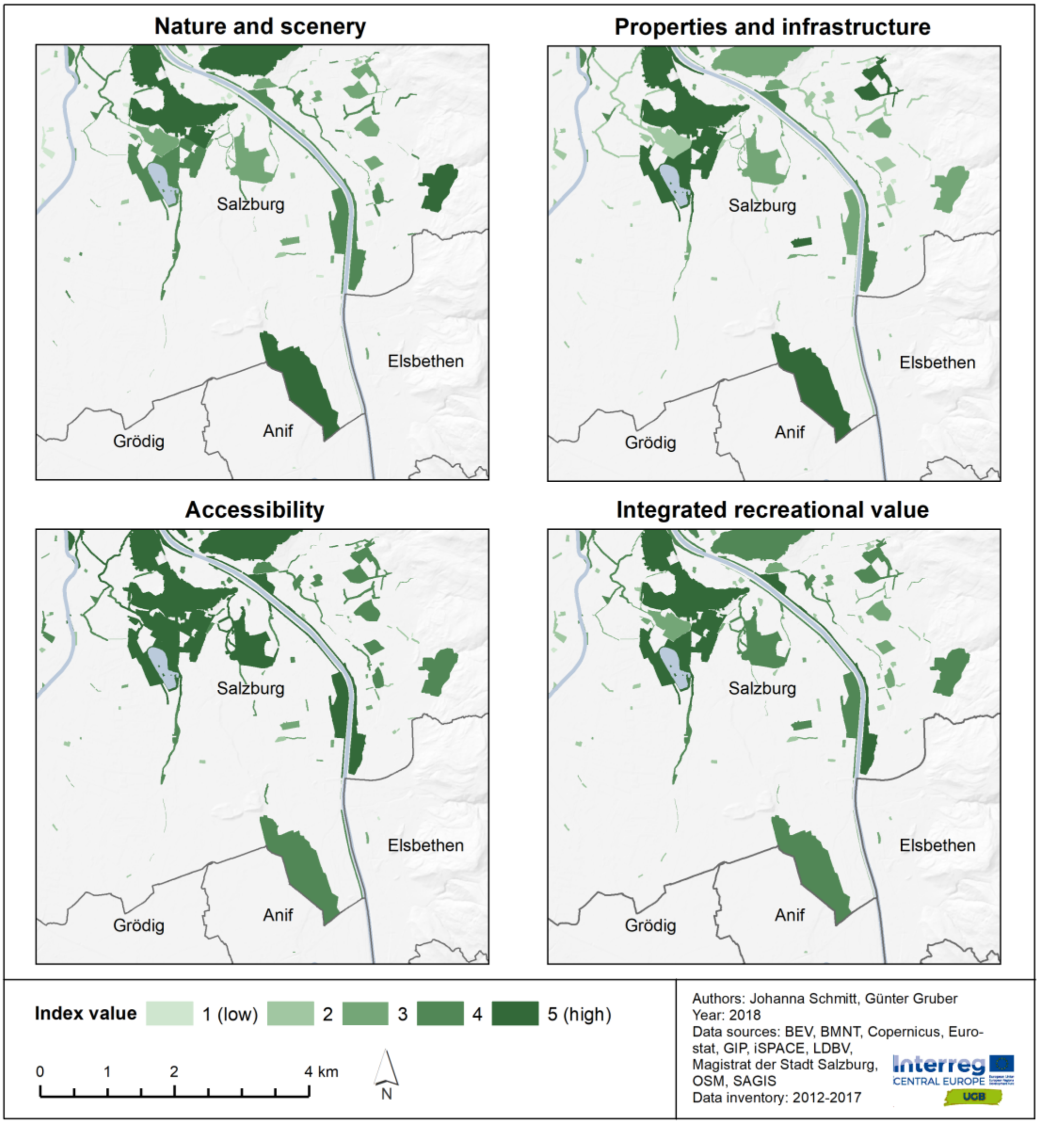

Figure 2: Comparison of the results for each index value and the integrated recreational value

Figure 3 is based on a population grid and displays the highest recreational quality level that can be accessed from each populated cell by using the average walking distance of 400m and the cycling distance of 3,500m. It shows that the supply in the city is good, even when only a short distance is considered acceptable. Due to the lower number of recreational areas in the rural regions outside the city of Salzburg, most of their inhabitants do not have good access to high-quality green recreational spaces, especially when assuming a maximum walking distance of 400m. The share of persons with good access increases with the larger acceptable distance (1,000m), but most of the recreational areas reachable, even by bike, from populated cells are only of medium or low quality.

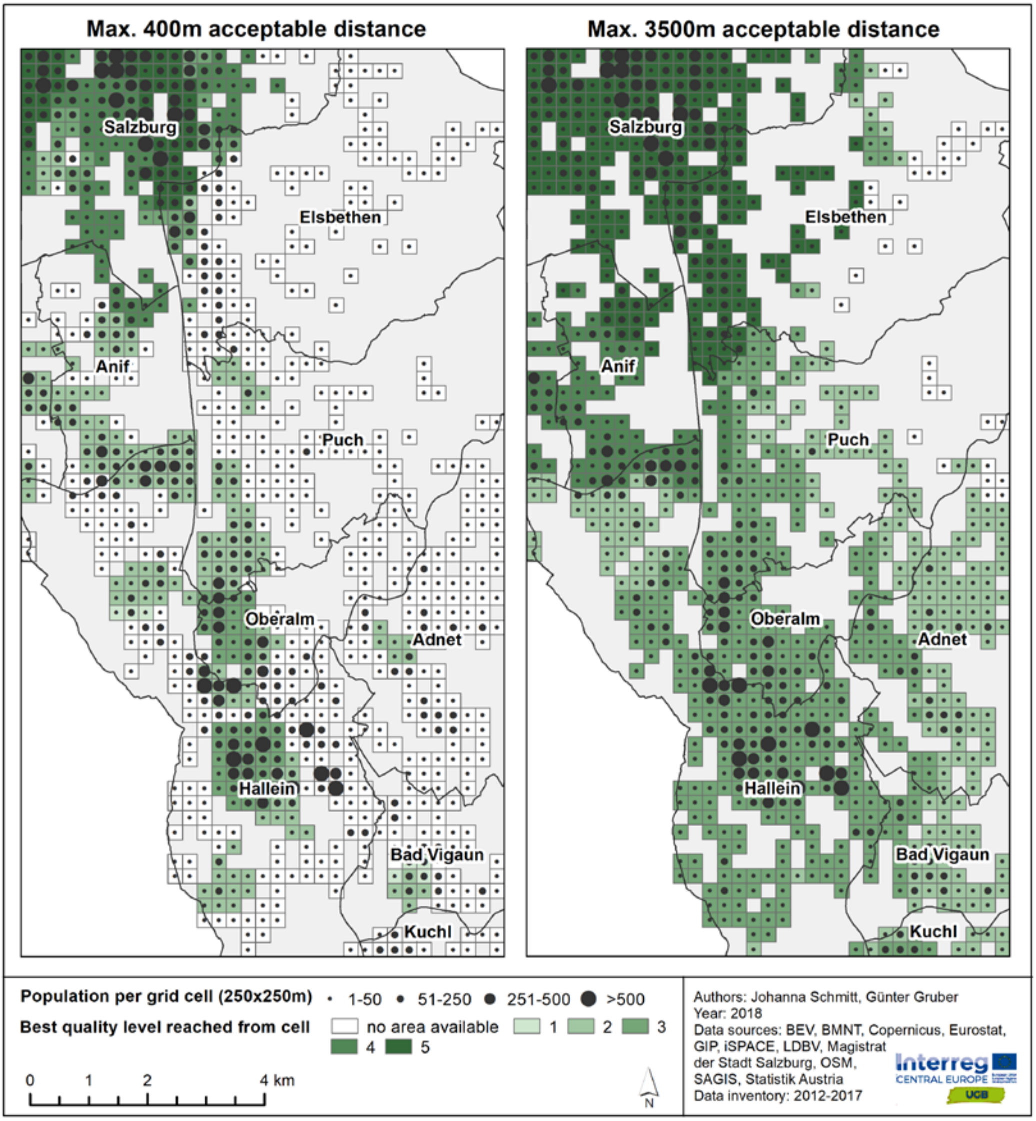

Figure 3: Supply with recreational areas by quality level, depending on the maximum acceptable distance

In Figure 4, the poorer supply of recreational areas in the part of the study area that falls outside the city becomes even more evident. Within a walking distance of 400m, over 40% of the population in the smaller municipalities has no access to any recreational area, compared to less than 15% in the study area as a whole. With larger distance values, the share of people with access to high-quality recreational areas increases, since in terms of acceptable cycling distance over 75% of the residents of the whole area have access to quality-level 4 or 5. A quality level of at least 3 is accessible for more than 40% of the residents using the longer walking distance, and for over 80% in cycling-distance terms, even in the peri-urban regions. Nevertheless, less than 10% of the population in the municipalities outside of the city has access to recreational areas of the highest level within a distance of 3,500m, which underlines the fact that the supply of high-quality areas is poor in these outlying locations.

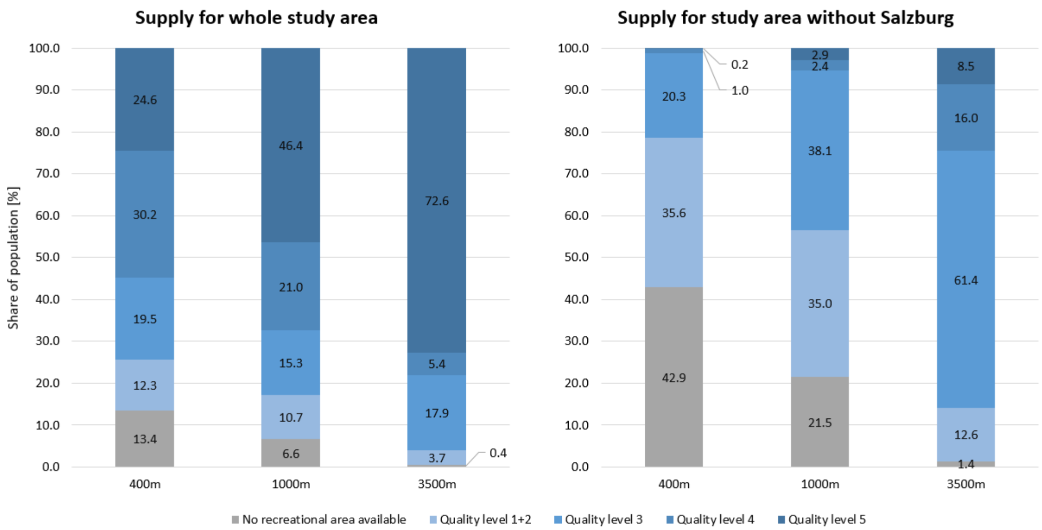

Figure 4: Supply with recreational areas of every quality level for residents in the study area as a whole (n=208,609) compared to the area excluding the city of Salzburg (n=60,776)

4 Discussion and outlook

This study shows that the recreational quality of existing green spaces in the pilot area is quite good, and highlights the fact that often there exist only one or two predominant assets with regard to the single indices. This applies to urban and suburban zones almost equally, mainly because of the greater natural value of non-urban GI. The integrated index value evens this phenomenon out to a certain extent, as in a combined assessment the urban areas surpass the more rural ones in the overall recreational quality, which is mainly due to the better accessibility and infrastructural setting of urban green spaces. A small amount of credit can, however, be given to the better availability of OSM data for urban areas. This insight becomes even more obvious when integrating residents into the analysis. High-quality green spaces based on experience criteria as well as recreational areas are available for a much higher proportion of city dwellers in all distance classes, whereas in the middle of the spectrum (medium quality) not many differences can be found in the short walking distance.

A deeper spatial evaluation of the indices will be conducted in the future, using a larger indicator set that takes into account the higher share of private green spaces in rural areas. To achieve a more accurate assessment of recreational quality, the indices can be expanded by more objective criteria, such as security issues for both the areas and their access routes. This implies crime rates as well as traffic-related impedances. We plan to use smart community-involvement methods in order for people's needs and expectations to be reflected better in planning guidelines. Surveys and social media data can potentially deliver arguments for appropriate upgrade actions and give insight into the attractiveness of certain facilities, so that distance alone is not the only criterion. As a consequence, this study can be linked to more complex location-allocation approaches to better determine demand and find suitable sites in areas with inadequate supply.

Acknowledgement

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